

What is claimed is:

1. A method for determining targeted water content in a predetermined environment comprising:

measuring water within solid waste by injecting at least two gas tracers within solid waste to measure a fraction of void space filled with water, and

determining an amount of water to be added to said environment, wherein one of said gas tracers is conservative and does not react with solids or liquids, and a second gas tracer partitions into the water and is separated from the conservative tracer during at least a portion of said method.

2. A method of claim 1 wherein said tracers comprise helium and .difluoromethane.

3. A method of claim 1, wherein said tracers are injected and chromatographic separation of the tracers is measured between a point of tracer injection and a point of tracer extraction such that the degree that the second partitioning tracer is retarded correlates to the average water saturation in the environment..

4. A method of claim 1, wherein said conservative tracer comprises at least one noble gas or one perfluorinated compound.

5. A method of claim 4, wherein said conservative tracer is selected from the group consisting of neon, helium, argon, and perfluorinated compounds.

6. A method of claim 5, wherein each of said conservative tracers has a low affinity for water (K_H) and has negligible affinity for solid waste (K_d) and a gas-water phase interface.

7. A system comprising

at least two tracers comprising:

- (i) a conservative tracer is that does not partition significantly into solids or liquids within landfills, and
- (ii) a partitioning tracer that partitions into bulk water, but has minimal affinity for a gas-water phase interface or for solid waste, and

a chromatograph capable of measuring separation of said at least two tracers after said tracers have been injected into a material.

8. A system according to claim 7, wherein each of said tracers are nontoxic, nonbiodegradable, and detectable within a gas phase.

9. A system according to claim 7, wherein said tracers are absent from landfill gas and/or found at negligible concentrations within said gas phase.

10. A method of claim 1, wherein said partitioning tracer comprises at least at least one of (1) halogenated aliphatic compounds, (2) weakly acidic and basic gases, and (3) polar organic compounds.

11. A method of claim 1, wherein said partitioning tracer is employed that has a retardation dominated by bulk water in the environment, such that sorption onto solid waste and a gas-water interface are negligible in comparison, and wherein said conservative tracer has minimal affinity for solid and liquid phases in the environment.

12. A method suitable for measuring water in a biofilter, said biofilter being engineered porous media intended to degrade pollutants in a gas stream, said method comprising
injecting at least two gas tracers within said biofilter to measure a fraction of void space filled with water, and
determining an amount of water to be added to said biofilter wherein one of said gas tracers is conservative and does not react with solids or liquids, and a second gas tracer partitions into the water and is separated from the conservative tracer during at least a portion

of said method.

13. A method of claim 12 ,wherein said water is supplied to said biofilter to maintain optimal moisture conditions for biodegradation.

14. A tracer kit comprising at least two tracers comprising

- (i) a conservative tracer that does not partition significantly into solids or liquids within landfills, and
- (ii) a partitioning tracer that partitions into bulk water found in landfills, but has minimal affinity for gas-water phase interface or for solid waste.

15. A kit of claim 14, wherein said tracers are nontoxic, nonbiodegradable over a predetermined time period, not easily detectable within the gas phase, and/or absent from landfill gas and/or found at only small concentrations within the gas phase.

16. A kit of claim 14, wherein said conservative tracer comprises at least one noble gas and/or one perfluorinated compound.

17. A kit of claim 14, wherein each of said tracers has a low affinity for water (K_n) and has negligible affinity for solid waste (K_d) and a gas-water phase interface.

18. A kit of claim 14, wherein said partitioning tracer comprises at least one of (1) halogenated aliphatic compounds, (2) weakly acidic and basic gases, and (3) polar organic compounds.